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(71) Applicant(s)

Uni-Charm Corporation

(Incorporated in Japan)

182 Shimobun, Kinsei-cho, Kawanoe-shi, Ehime-ken,
Japan

Mitsui Petrochemical Industries Ltd

(Incorporated in Japan)

3-2-5 Kasumigaseki, Chiyoda-ku, Tokyo,
United Kingdom

(72) Inventor(s)

Takamitsu Igaue
Tsutomu Kido

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Hisashi Takai

(74) Agent and/or Address for Service

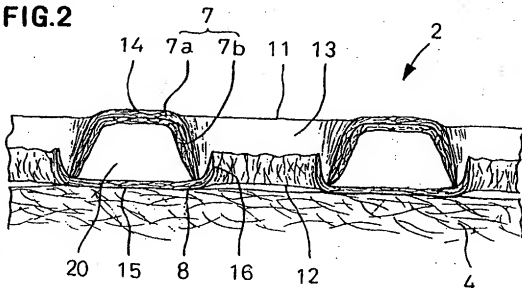
Baron & Warren

16 South End, Kensington, LONDON, W8 5BU,
United Kingdom

(54) Topsheet for use in disposable body fluid absorptive goods

(57) A topsheet for use in body fluid absorptive goods comprises an upper sheet 7 having a skin-contacting area 14 and liquid passages 13 and a lower sheet 8 underlying the upper sheet 7 and defining cavities 20 therewith. The lower sheet 8 is welded to the upper sheet 7 around lower openings 12 of the respective liquid passages 13 so as to restrict deformation of these passages which would otherwise possibly occur. The lower sheet 8 is of melt-blown fibres and the upper sheet 7 may comprise two layers of melt-blown fibres or may be of thermoplastic film.

FIG.2



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FIG.1

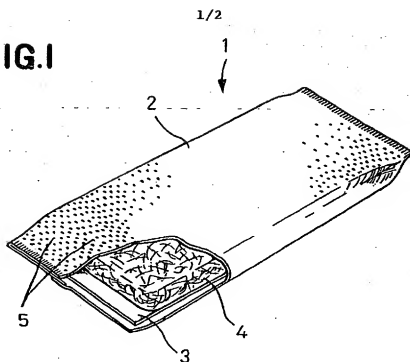


FIG.2

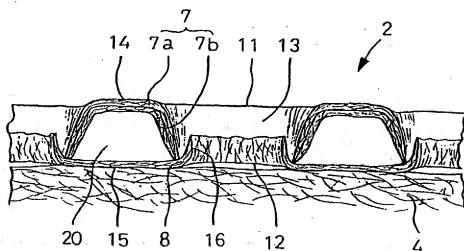
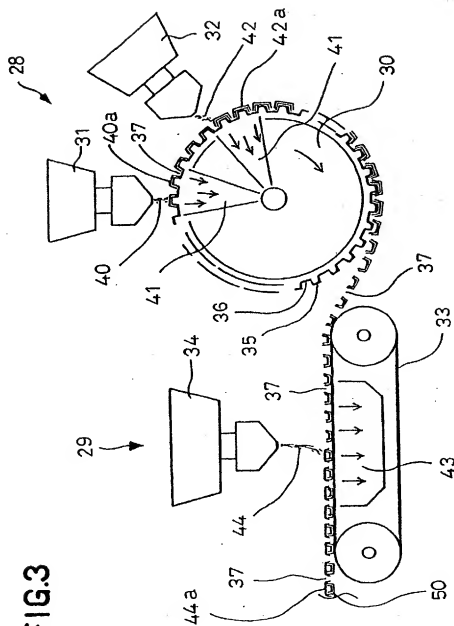


FIG.3



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TOPSHEET FOR USE IN DISPOSABLE
BODY FLUID ABSORPTIVE GOODS

The present invention relates to liquid-permeable topsheets for use in disposable body fluid absorptive goods such as sanitary napkin, disposable diaper and training pants.

Concerning liquid-permeable topsheets used for body fluid absorptive goods, a technique is well known to make a topsheet from plastic film or nonwoven fabric, to provide the topsheet with liquid passages each extending therethrough from top to bottom thereof, an upper surface of the sheet being adapted to be in contact with the wearer's skin, and to arrange lower openings of the respective liquid passages so as to be in contact with an absorbent core so that a capillary action occurring within each liquid passage may be utilized to transfer excreted body fluids toward the absorbent core.

For example, Japanese Patent Publication No. 1982-17081 discloses a technique according to which a topsheet made of polyethylene film is provided with conically tapered liquid passages and the lower ends of the respective passages are arranged so as to be closely in contact with an absorbent

core.

According to a technique disclosed by Japanese patent application Disclosure Gazette No. 1985-259261, a topsheet made of plastic film is provided with cylindrical liquid passages with their lower ends extending into an absorbent core, on one side, and a fibrous layer is bonded to the lower surface of the topsheet with fibres of said fibrous layer extending into the liquid passages, on the other side. Such cylindrical liquid passages are more stable and therefore less deformable than the conical liquid passages under a same large load. Additionally, the cylindrical liquid passages are preferred to the conical liquid passages in that the fibres extending into the liquid passages also contribute to accelerate body fluids to be transferred toward the absorbent core under the capillary action.

According to a technique disclosed by Japanese patent application Disclosure Gazette No. 1992-152945, there is provided a high density area or rib continuously surrounding lower openings of respective liquid passages. This technique certainly stabilizes the opening of each liquid passage against deformation as well as collapse and allows body fluids to be effectively transferred toward an absorbent core.

Soft touch is essential to a topsheet, and therefore such conventional topsheets as disclosed by the above-mentioned Patent Publication and Disclosure Gazettes are also made from thin and soft materials. With a negative consequence, however, such conical liquid passages disclosed by said Japanese Patent Publication No. 1982-17081 as well as such cylindrical liquid passages as disclosed by said Japanese patent application Disclosure Gazette No. 1985-259261 are disadvantageous in that the lower openings, ie, free ends of those liquid passages are liable to be deformed, so the liquid passages can readily collapse, for example, under a body weight of a wearer and body fluids are often prevented thereby from being smoothly transferred toward an absorbent core. While a stability of each liquid passage against a compressive force axially exerted on this liquid passage can be more or less improved, such a liquid passage is still ready to be collapsed under a force transversely exerted on it since it comprises soft material after all. While the technique disclosed by the above-mentioned Japanese patent application Disclosure Gazette No. 1992-152945 may theoretically alleviate a problem that a liquid passage is apt to be collapsed, both a thickness of the topsheet and a diameter of the liquid passage are unfeasibly fine, so it

would not be easy to provide the previously mentioned high density area or rib continuously surrounding the lower openings of the respective liquid passages although this is one of the most important features of the disclosed technique.

In view of these problems left behind by the prior art unsolved, it is a principal object of the invention to provide a topsheet comprising a first sheet and a second sheet underlying said first sheet wherein said first sheet is provided with liquid passages and said second sheet is welded to said first sheet around the lower openings of the respective liquid passages so as to restrict possibly occurring deformation of the liquid passages and thereby to solve the problems encountered by the conventional topsheets.

The object set forth above is achieved, according to the invention, by a topsheet for use in body fluid absorptive goods, said topsheet being provided with a plurality of liquid passages each extending through the topsheet from an upper opening to a lower opening thereof and a skin-contacting area continuously formed around the upper openings of the respective liquid passages, characterized by that said

topsheet comprises a first sheet comprising thermoplastic film or nonwoven fabric of thermoplastic fibres welded to each other, said liquid passages and skin-contacting area, and a second sheet underlying said first sheet and comprising nonwoven fabric of thermoplastic fibres welded to each other and to said first sheet around lower openings of the respective liquid passages, and individual fibres extending upward and loosened from said second sheet around said lower openings into the respective liquid passages along inner walls thereof so that said second sheet is spaced from said first sheet except around said lower openings and thereby cooperates with said first sheet to define cavities extending in the direction of the topsheet's thickness.

Preferably, the second sheet is hydrophilic in comparison with the first sheet.

Such topsheet is obtained, for example, by blowing melt fibres from an extruder against the underside of the first sheet provided with the liquid passages and thereby forming melt-blown nonwoven fabric so that said melt-blown fibres can be welded to the first sheet around the lower openings of the respective liquid passages and contribute to protect these passages from being deformed in the proximity of their lower openings. The first sheet and the second sheet are

continuous with each other around the upper and lower openings of the respective liquid passages, so the liquid passages are substantially stabilized against deformation and collapse under an axial force as well as a transverse force exerted thereon.

Liquid excretions flow into the liquid passages and reach the respective lower openings, whereupon the liquid excretions are absorbed by the absorbent core at spots of the core being in contact with the respective lower openings, then spread over the second sheet and are absorbed by the absorbent core also over an area being in contact with the second sheet. However, the second sheet thus wetted as a result of said spreading gives no significant wet touch to a wearer, since the second sheet is welded to the first sheet around the respective lower openings but well spaced from the first sheet in the remaining zone.

The invention will be described by way of example with reference to the accompanying drawings, in which:

Fig.1 is a perspective view showing, as partially broken away, a sanitary napkin, in accordance with one embodiment of the invention.

Fig.2 is a sectional view partially showing a topsheet of the sanitary napkin

in an enlarged scale; and

Fig. 3 is a schematic diagram illustrating a topsheet manufacturing process.

Referring to Fig. 1, a sanitary napkin 1 is shown in a perspective view as partially broken away. As shown, the napkin 1 comprises a liquid-permeable topsheet 2, a liquid-impermeable backsheet 3 and an absorbent core 4 sandwiched between these two sheets 2, 3, wherein the topsheet 2 entirely envelops the absorbent core 4 with the opposite side portions thereof being overlapped and sealed together on the backside of the napkin 1 and end portions extending along opposite ends of the absorbent core 4 being also sealed together. The backsheet 3 is interposed between the topsheet 2 lying on the backside of the napkin 1 and the absorbent core 4.

Referring to Fig. 2, the topsheet 2 is schematically illustrated in a partial section cut in the direction of its thickness. As illustrated, the absorbent core 4 is contacted to the underside of the topsheet 2. The topsheet 2 comprises an upper sheet 7 which comprises, in turn, a laminate of a first layer 7a and a second layer 7b both made of melt-blown

fibres, and a lower sheet 8 underlying said upper sheet 7 and made of melt-blown fibres. The upper sheet 7 includes a plurality of liquid passages 13 each extending through the sheet 7 from an upper opening 11 to a lower opening 12 and a skin-contacting area 14 which is formed as a continuous planar zone extending around the respective upper openings 11. The lower sheet 8 includes a planar area 15 which is formed as a continuous planar zone around the respective lower openings 12 and rising areas 16 extending from said planar area 15 upwardly into the respective liquid passages 13. The melt-blown fibres constituting the lower sheet 8 are welded to the upper sheet 7 around the respective lower openings 12 and thereby the lower sheet 8 is integrated with the upper sheet 7. However, these sheets 7, 8 define therebetween cavities 20, since the skin-contacting area 14 and the planar area 15 are spaced from each other.

Referring to Fig. 3, a process of manufacturing the topsheet 2 is schematically illustrated. The process comprises a first forming step 28 utilizing a forming drum 30 and first and second melt-blowing extruders 31, 32 provided around said forming drum 30 and a second forming step 29 utilizing an endless belt 33 and a third melt-blowing extruder 34 provided above said endless belt 33. The forming

drum 30 is provided around its outer peripheral surface with protrusions 35 and indents 36 which are alternately arranged and serve as forming dies so that melt-blown fibres 40 are blown from the first extruder 31 against said forming dies under effect of suction 41 to form a nonwoven fabric layer 40a destined to be the first layer 7a of the first sheet 7. Similarly, melt-blown fibres 42 are blown from the second extruder 32 against the nonwoven fabric layer 40a to form a nonwoven fabric layer 42a destined to be the second layer 7b of the first sheet 7. A laminate of these nonwoven fabric layers 40a, 42a is then formed by the drum 30 into a continuity of the first sheet 7 having the skin-contacting area 14 of the first sheet 7 formed by the protrusions 35 and the liquid passages 13 formed by the indents 36. It should be understood that various factors such as respective amounts of the fibres 40, 42 to be blown, intensity of respective suction 41 and depth of each indent 36 may be adjusted during the first forming step 28 to obtain a continuity of the first sheet 7 containing the fibres 40, 42 extending upward along side walls of the respective indents 36 so as to form the liquid passages 13 and openings formed by bottoms of the respective indents 36 destined to be the lower openings 12 of the first sheet 7. The continuity of the first sheet 7 is

separated from the peripheral surface of the forming drum 30 as it is transferred from the first forming step 28 to the second forming step 29, and laid on the endless belt 33 with its surface which has contacted the peripheral surface of the forming drum 30 facing upward. Under effect of a suction 43, melt-blown fibres 44 are blown against said surface facing upward to form a nonwoven fabric layer 44a destined to be the second sheet 8. Amount of the fibres 44a to be blown and intensity of the suction 43 may be adjusted to assure that the fibres 44 are loosened around the openings 37 without formation of an apparent nonwoven fabric layer and extend upward into the liquid passages 13 along their inner walls but never fill up the openings 37 destined to be the lower opening 12. The roll of sheet 50 comprising these nonwoven fabric layers 40a, 42a, 44a obtained in the manner as has been described above can be unrolled and cut into sheets of desired dimensions so as to be used as the individual topsheets 2.

In each topsheet 2 cut from the roll of sheet 50, the melt-blown fibres 40, 42 forming the first or upper sheet 7 are fluffed around the lower openings 12 in the direction of the suction 41. The melt-blown fibres 44 blown from the third extruder 34 against this upper sheet 7 are welded and/or

clung to the other melt-blown fibres 40, 42 and thereby integrate the second or lower sheet 8 with the upper sheet 7. By forming the upper sheet 7 in two-layered structure comprising the melt-blown nonwoven fabric layers 40a, 42a as in the illustrated embodiment wherein the lower layer 40a of melt-blown nonwoven fabric having a higher density is first formed in order to make the topsheet 2 firm and then the upper layer 42a of melt-blown nonwoven fabric having a lower density is formed, it will be easily achieved to provide the goods utilizing such topsheet 2 which can give its wearer a cloth-like soft touch. It should be understood that the upper sheet 7 may be also formed by any one of the nonwoven fabric layers 40a, 42a.

The melt-blown fibres 40, 42, 44 may be of suitable thermoplastic resin such as polyethylene. It is also possible within the scope of the invention to replace the melt-blown nonwoven fabric of the upper sheet 7 by perforated plastic film. Preferably, the upper sheet 7 is made from suitable hydrophobic material so that a dry touch may be maintained even after excretion of body fluids, on one hand, and the lower sheet 8 is made hydrophilic in comparison with the upper sheet 7 so that the body fluids may be transferred toward the absorbent core and extensively spread over the

lower sheet 8 as rapidly as possible, on the other hand. Such lower sheet 8 may be obtained, for example, by using polyethylene previously mixed with hydrophilic agent.

In the topsheet constructed according to the invention, the liquid passages are effectively shape-stabilized and difficult to be blocked, since the lower sheet is welded to the upper sheet around the lower openings of the respective liquid passages.

The body fluids excreted over the topsheet flow into the liquid passages and reach the lower openings of the respective liquid passages, whereupon the body fluids are absorbed by the portions of the absorbent core being in contact with these lower openings and simultaneously spread over the lower sheet, so the body fluids are absorbed also by the portion being in contact with said lower sheet. In this manner, the topsheet of the invention allows the absorption rate to be improved over the topsheet of prior art.

The lower sheet of the topsheet gives no wet touch to the wearer even after the lower sheet has been wetted with the body fluids spreading thereover, since there are the cavities defined between the upper sheet and the lower sheet.

An excellent shape-stability of the liquid passages improves a cushioning effect and therefore comfort of wearing

the absorptive goods.

CLAIMS

1. A topsheet for use in body fluid absorptive goods, said topsheet being provided with a plurality of liquid passages each extending through the topsheet from an upper opening to a lower opening thereof and a skin-contacting area continuously formed around the upper openings of the respective liquid passages, wherein

said topsheet comprises a first sheet comprising thermoplastic film or nonwoven fabric of thermoplastic fibres welded to each other, said liquid passages and skin-contacting area, and a second sheet underlying said first sheet and comprising nonwoven fabric of thermoplastic fibres welded to each other and to said first sheet around lower openings of said respective liquid passages, and individual fibres extending upward and loosened from said second sheet around said lower openings into said respective liquid passages along inner walls thereof so that said second sheet is spaced from said first sheet except around said lower openings and thereby cooperates with said first sheet to define cavities extending in the direction of the thickness of the topsheet.

2. The topsheet according to Claim 1, wherein said second sheet is hydrophilic in comparison with said first

sheet.

3. The topsheet according to Claim 1 or 2, wherein said first sheet comprises perforated polyethylene film and said second sheet comprises melt-blown nonwoven fabric of polyethylene.

4. The topsheet according to Claim 1 or 2, wherein both said first sheet and said second sheet comprise melt-blown nonwoven fabric of polyethylene.

5. The topsheet according to any preceding claim, wherein said second sheet comprises melt-blown nonwoven fabric of polyethylene previously mixed with hydrophilic agent.

6. The topsheet according to any preceding claim, wherein said first sheet comprises upper and lower layers of nonwoven fabric, the upper layer having a density which is lower than that of the lower layer.

7. The topsheet according to Claim 6, wherein both said upper and lower layers comprise melt-blown nonwoven fabrics.

8. A topsheet comprising a first sheet and a second sheet underlying said first sheet, said first sheet being provided with liquid passages and said second sheet being welded to said first sheet around the lower openings of the respective liquid passages so as to restrict possibly occurring deformation of the liquid passages.

9. A topsheet for use in body fluid absorptive goods, said topsheet being substantially as herein de-

scribed with reference to the accompanying drawings.

10. Body fluid absorptive goods including a top-sheet as claimed in any preceding claim.

11. Body fluid absorptive goods substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

17

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Relevant Technical Fields

- (i) **UK Cl (Ed.M)** DIR (RAA, RBF, RCA, RFQ, RFZ, RGQ, RGZ)
 (ii) **Int Cl (Ed.5)** A61F 13/15; A16L 15/00; B32B 3/24, 5/02; D04H 13/00

Search Examiner
 ALEX LITTLEJOHN

Date of completion of Search
 27.1.94

Databases (see below)

(i) **UK Patent Office collections of GB, EP, WO and US patent specifications.**

Documents considered relevant following a search in respect of Claims :-
 1-7

(ii)

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A: Document indicating technological background and/or state of the art. **&:** Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2180271 A	(KIMBERLY-CLARK) see whole document, especially page 7 lines 51-53 and 81, 82	-
A,P	EP 0545423 A1	(UNI-CHARM) see whole document, especially column 6 lines 29-34	-
A	US 4726976	(KARAMI) see whole document, especially column 4 lines 7-32	-
A	US 4184902	(KARAMI) see whole document, especially column 3 lines 47-63	-

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